Hydrologic and Nutrient Response Following Long Term Adoption of No-Till

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There is a growing body of evidence that suggests long-term no-tillage practices may lead to increased subsurface transport of water and nutrients. The increased adoption of no-till practices in regions with widespread subsurface artificial drain lines may not have a profound effect on nutrient export as reductions in surface runoff transport may be offset by increased subsurface export. In this study we compare the effects of long term no-till and reduced till systems on the subsurface transport of water, nitrate, and soluble reactive phosphorus.

We used distributed temperature sensing technology (DTS) as a tool to quantify preferential transport in both tillage systems. Temperature along 500 m fiber optic cable installed in artificial drains in a paired no-till and reduced till field was used as a tracer during spring snowmelt conditions. Temperature and flow measurements indicted more rapid transport of water to the artificial drain lines under no-till management. Adoption of no-till has nearly eliminated surface runoff however the excess water leads to a greater proportion of subsurface losses through artificial drains.

Nitrate concentration and loading through subsurface drains was greater in the no-till field that the conventionally tilled field. Higher nitrate concentrations are likely due to increased N mineralization and preferential transport in no-till fields. Soluble reactive phosphorus concentrations in subsurface drainage exceeded the 0.1 ppm upper limit commonly used in TMDL assessments in north Idaho. Soil core experiments indicated that phosphorus leaching occurs primarily in small targeted areas having high plant available soil phosphorus often in soil deposition areas. This research highlights the need to better account for long term effects of no-till adoption and artificial drainage on fertilizer management and nutrient export.